

CLAIMS

WHAT IS CLAIMED:

1. A fluid control and gas delivery assembly for safely containing, receiving and storing hazardous fluids and for dispensing gas comprising:
 - a. a container having a wall separating an interior volume from a region outside said container, wherein said container is adapted for containing a fluid at a first pressure;
 - b. a fluid fill path extending through said wall from said region outside said container to said interior volume;
 - c. a gas dispensing path extending through said wall from said interior volume to said region outside said container, said gas dispensing path being non-coextensive with said fluid fill path;
 - d. a first shut-off valve positioned in said gas dispensing path;
 - e. a pressure reducer positioned in said gas dispensing path downstream of the first shut-off valve to reduce the pressure of the fluid flowing upstream of the pressure reducer to a delivery pressure;
 - f. a fluid flow restrictor positioned in said gas dispensing path downstream of the pressure reducer, said restrictor having a fluid flow restricting path configured to restrict the flow of the fluid delivered to the fluid flow restrictor at the delivery pressure to a maximum mass flow rate that is equal to or less than the allowable mass flow rate standard for the hazardous fluid;
 - g. a second shut-off valve positioned in said gas dispensing path downstream of said pressure reducer; and
 - h. a fluid outlet connector disposed in said gas dispensing path downstream of said first and second shut-off valves and

adapted for making and breaking a low-pressure connection between said gas dispensing path and apparatus for utilizing gas.

2. The fluid control and gas delivery assembly of claim 1, wherein the fluid flow restricting path is configured to limit the flow of gas delivered to the fluid flow restrictor at the delivery pressure to a mass flow rate that exceeds a maximum allowable flow rate standard at the first pressure for said fluid.

3. The fluid control and gas delivery assembly of claim 1, wherein the fluid flow restrictor comprises one or more orifices, flow nozzles, venturis, filters, screens or capillary tubes.

4. The fluid control and gas delivery assembly of claim 1, wherein the fluid flow restrictor is located in said outlet.

5. The fluid control and gas delivery assembly of claim 1 further comprising a residual pressure valve located in the gas dispensing path, upstream of the first shut-off valve, to prevent back flow of air or foreign fluids.

6. The fluid control and gas delivery assembly of claim 1 further comprises a purge-gas flow path having a purge gas inlet that communicates with the gas dispensing path between the first shut-off valve and the pressure reducer.

7. The fluid control and gas delivery assembly of claim 6, wherein a purge-gas valve is positioned in the purge-gas flow path to selectively open and sealingly close said purge-gas flow path.

8. The fluid control and gas delivery assembly of claim 1 further comprises a flow switch for controlling the fluid flow along the gas dispensing path.

9. The fluid control and gas delivery assembly of claim 8, further comprising a processor coupled in controlling relationship with the flow switch.

10. The fluid control and gas delivery assembly of claim 1 further comprising a purifier disposed within the container and upstream of the first shut-off valve.

11. The fluid control and gas delivery assembly of claim 1 further comprising a high pressure safety relief device upstream of the pressure reducer.

12. The fluid control and gas delivery assembly of claim 1, wherein said fluid fill path, gas dispensing path, pressure reducer, shut-off valves, fluid flow restrictor and outlet connector are defined by a primary gas control module mounted on said container.

13. The fluid control and gas delivery assembly according to claim 1, further comprising an automatic controller for operating the first shut-off valve to control the discharge of gas deriving from the fluid container.

14. The fluid control and gas delivery assembly of claim 1, wherein said hazardous fluid is selected, as required by the user's application, from the fluids consisting of: corrosive, toxic, oxidant, pyrophoric fluids and mixtures of such fluids.

15. The fluid control and gas delivery of assembly claim 1, further comprising a fluid fill valve positioned to control the flow of gas along said fluid fill path.

16. A semiconductor manufacturing system comprising a semiconductor manufacturing apparatus utilizing a gas, and a source of said gas, wherein said source comprises a fluid control and gas delivery assembly according to claim 1.

17. A method of manufacturing a semiconductor product, comprising: containing a fluid in a confined state in a fluid control and gas delivery assembly according to claim 1; selectively dispensing the confined fluid by actuating the first shut-off valve to discharge the gas from the fluid container; and using the discharged gas in the manufacture of a semiconductor product

18. A method for storage and dispensing of a gas, comprising: containing a gas in a confined state in a fluid control and gas delivery assembly according to claim 1; and selectively dispensing the confined gas by actuating the first shut-off valve to discharge the gas from the container.

19. A method for replacing the source of gas, in an apparatus for utilizing the gas, without breaking a high pressure connection comprising:

- providing first and second supplies of gas, each supply comprising a fluid container adapted for storing a fluid at a first pressure and having a wall separating an interior volume from a region outside said fluid container and a primary gas control module mounted on said fluid container, said module defining:
 - a. a gas dispensing path extending through said wall from said interior volume to said region outside said container;
 - b. a first shut-off valve positioned in said gas dispensing path;
 - c. a pressure reducer positioned in said gas dispensing path downstream of the first shut-off valve to reduce the pressure

of the fluid flowing upstream of the pressure reducer to a delivery pressure;

- d. a fluid flow restrictor positioned in said gas dispensing path downstream of the pressure reducer and upstream of an outlet, said restrictor having a fluid flow restricting path configured to restrict the flow of the fluid delivered to the fluid flow restrictor at the delivery pressure to a maximum mass flow rate that is equal to or less than the maximum allowable mass flow rate standard for the hazardous fluid;
 - e. a second shut-off valve positioned in said gas dispensing path downstream of said pressure reducer; and
 - f. an outlet connector disposed in said gas dispensing path downstream of said first and second shut-off valves and adapted for making and breaking a low-pressure connection between said gas dispensing path and apparatus for utilizing gas;
- providing apparatus for using the gas, said apparatus having a low-pressure inlet and an inlet connector, said inlet connector initially being coupled to the outlet connector of said first supply of gas to supply gas from said first supply to said apparatus;
 - closing the shut-off valve of said first supply of gas to isolate said first supply of gas from said apparatus for using the gas;
 - breaking the low-pressure connection between the connectors of said first supply of gas and said apparatus for using the gas;
 - replacing said first supply of gas with said second supply of gas;
 - while the shut-off valve of said second supply of gas is closed, making a low-pressure connection between the connectors of said second supply of gas and said apparatus for using the gas; and
 - opening the shut-off valve of said second supply of gas, allowing gas to flow from said second supply to said apparatus for using the gas.

20. The method of claim 19, further comprising refilling said first supply of gas via said fluid fill path.

21. The method of claim 19 wherein said apparatus for using the gas comprises a tool for manufacturing an integrated circuit.